DOCUMENT RESUME

ED 402 819 HE 029 736

AUTHOR Whitmire, Ethelene
TITLE Undergraduate Students' Development of Critical Thinking Skills: An Institutional and Disciplinary Analysis and Comparison with Academic Library Use and Other Measures. ASHE Annual Meeting Paper.
INSTITUTION Michigan Univ., Ann Arbor. Center for the Study of Higher and Postsecondary Education.
PUB DATE Nov 96
NOTE 29p.; Paper presented at the Annual Meeting of the Association for the Study of Higher Education (21st, Memphis, TN, October 31 - November 3, 1996).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Academic Libraries; *College Environment; College Libraries; *Critical Thinking; Educational Environment; Higher Education; *Intellectual Development; Intellectual Disciplines; Self Evaluation (Individuals); *Student Characteristics; Student Experience; Student School Relationship; Thinking Skills; *Undergraduate Students
IDENTIFIERS *ASHE Annual Meeting

ABSTRACT

This study examined the influence of background characteristics, disciplinary differences, institutional context, academic library experiences, and the perceptions of the college environment on the estimated gains of critical thinking skills in undergraduate students (N=9,361). The study used data from a national, cross-sectional survey completed by undergraduate students during the academic year. Results of multiple regression analyses indicated that a student's perception of the college environment was the best predictor of a student's estimated gains in critical thinking skills. Students who perceived their college environment to be scholarly were more inclined to report greater gains in critical thinking skills. Student use of the academic library and background characteristics of students were not predictors of estimated gains in critical thinking skills. Students attending associate of arts institutions reported higher perceptions of increased critical thinking skills than students in research, comprehensive, and liberal arts schools. Additionally, students in the humanities reported lower estimated gains in critical thinking skills when compared with students majoring in the physical sciences, social sciences, business, and engineering. The findings suggest that students' background characteristics and the academic library do not have a great impact on developing the critical thinking skills of undergraduate students. (Contains 21 references.) (Author/PRW)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 402 819

Undergraduate Students' Development of Critical Thinking Skills: An Institutional and Disciplinary Analysis and Comparison with Academic Library Use and Other Measures

by
Ethelene Whitmire
The University of Michigan
Center for the Study of Higher and Postsecondary Education
School of Education
610 E. University, 2108 SEB
Ann Arbor, MI 48107-1259

BEST COPY AVAILABLE

IR 021 736

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☒ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

ASHE

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

ASHE

ASSOCIATION
FOR THE
STUDY OF
HIGHER EDUCATION

Texas A&M University
Department of Educational
Administration
College Station, TX 77843
(409) 845-0393

This paper was presented at the annual meeting of the Association for the Study of Higher Education held in Memphis, Tennessee, October 31 - November 3, 1996. This paper was reviewed by ASHE and was judged to be of high quality and of interest to others concerned with higher education. It has therefore been selected to be included in the ERIC collection of ASHE conference papers.

Undergraduate Students' Development of Critical Thinking Skills: An Institutional and Disciplinary Analysis and Comparison with Academic Library Use and Other Measures

Abstract

The primary purpose of this study is to examine the influence of background characteristics, disciplinary differences, institutional context, academic library experiences, and the perceptions of the college environment on the estimated gains of critical thinking skills in undergraduate students. The study examines data from a national, cross-sectional survey completed by undergraduate students during the academic year. Results of multiple regression analyses indicate that students' perception of the college environment is the best predictor of students' estimated gains in critical thinking skills. Use of the academic library and student background characteristics were not as crucial in predicting estimated gains in critical thinking skills. Further, students attending associate of arts institutions reported higher perceptions of increased critical thinking skills. Additionally, students in the humanities reported lower estimated gains in critical thinking skills when compared with students majoring in the physical sciences, social sciences, business, and engineering. Implications of the findings suggest that students' background characteristics and the academic library is not having a great impact on developing the critical thinking skills of undergraduate students.

Introduction

The development of critical thinking skills is a significant component of undergraduate education. Academic libraries have also began trying to infuse the development of critical thinking into library services and programs. In fact, academic librarians and faculty have collaborated on incorporating academic library use into the curriculum and fostering critical thinking among undergraduate students (Gowler, 1995; MacAdam & Kemp, 1989; Mech, 1990). Consequently, "critical thinking in higher education has been the focus of considerable discussion and program development within academic libraries in recent years" (MacAdam, 1995). Examining the disciplinary context of almost all academic endeavors is important for those who work in higher education (Hativa & Marincovich, 1996). Investigating the academic library experiences of undergraduates within the disciplinary context is no exception. Plum (1984) examined the development of critical thinking skills in library instruction using the academic discipline as the framework.

The purpose of this study is to examine the influence of background characteristics, disciplinary differences, institutional context, academic library experiences, and the perceptions of college environment on the development of critical thinking skills in undergraduate students. My specific research question is: (1) What is the influence of background characteristics including disciplinary and institutional differences, academic library experiences, and perceptions of the college environment on the development of students' critical thinking skills?

Conceptual Framework

The literature from several areas frames my inquiry: higher education literature on college environments (including literature on disciplinary differences), empirical academic library use studies, and theoretical papers on critical thinking. Studies about disciplinary differences have found that academic departments are subenvironments of the college environment.

Differences in academic disciplines are evident in class size, course content, and instructional methods (Astin, 1993). Further, Weaver (1981) found that "the character of academic disciplines profoundly influences the curricular organization and pedagogical practices of undergraduate education" (p. 151). Becher (1987) asserts that "commonly, the characteristics of a given discipline begin to come quite sharply into focus at the undergraduate stage" (p. 281). Finally, Becher (1987) found that "it is the parent discipline that most strongly influences the characteristic features of its intellectual offspring" (p. 278). Indeed, Wells (1995) found that the most significant factor associated with academic library use was the discipline the student was studying. Plum (1984) found that the most useful framework to examine library use and the development of critical thinking was within the context of the discipline. Each discipline has a "distinctive process of original research, literature structures, and library systems that organize and identify that literature" (p. 32).

In addition to examining disciplinary differences, I also examined distinctions between disciplines within distinctive institutional contexts. Institutions have particular climates defined as "persistent patterns or norms, values, practices, beliefs, and

assumptions that shape the behavior of individuals and groups in a college or university" (Kuh and Whitt, 1988). However, other authors suggest that disciplinary cultures transcend institutional and national boundaries (Becher, 1994, p. 153). Weaver (1981) declares that "by the late 1940s and early 1950s, the department had become the point of intersection between disciplines and institutions" (p. 154).

The third set of studies that frame my research is academic library use literature. Older students were found to borrow the most items from the academic library (Mays, 1986). Gender has not been a consistent predictor of library use. In schools that had a more even distribution of male and female students, females outborrowed the males (Mays, 1986). Lane (1966) found that the majority of men borrowed no books. Females did not use the library bibliographical tools more than the male students according to Hiscock (1982). Additionally, of the students who remained in school, men borrowed more than women (Kramer & Kramer, 1968). Kramer & Kramer (1968) found the majority of freshmen (65%) borrowed no books. Seniors used the library the most, next came sophomores, and then freshmen. In terms of borrowing, the number of books borrowed increased from freshmen to sophomore to junior year with a slight decrease in senior year (Lane, 1966). Reluctance to ask librarians questions decreased with each class year, for example, juniors were less afraid to approach librarians than were freshmen (Kosa, 1982). Generally, the higher the grade point average (GPA) the more books borrowed (Mays, 1986). There was a positive correlation between (1) grade achieved and the total time spent in the library during the semester, and (2) frequency of library visits

and grade achieved, and (3) average amount of time spent in the library and grade achieved, but they were not statistically significant (Wells, 1995).

A positive correlational relationship between GPA and the number of books withdrawn failed to reach statistical significance (Lane, 1966). The students with the highest GPAs did the most borrowing (Kramer & Kramer, 1968). Students with low GPAs who continued or persisted made significantly greater use of the facilities, including the library, than students with low GPAs who dropped out of college (Churchill & Iwai, 1981).

The most significant factor associated with academic library usage was the discipline the student was studying (Mays, 1986). According to Wells (1995) "liberal arts subject areas were associated with more library use and it was conjectured that students in vocational courses such as business have more clearly defined academic goals which preclude the search for ideas, knowledge and prescribed information. Another tentative conclusion was that many of the disciplines associated with reduced measured library use are journal-dependent, and in-library use was not calculated." In general, students majoring in the fields of education, English, history, and political science, and possibly biology and nursing, consistently withdrew more books than students in other major fields (Lane, 1966). Previous studies have been conducted evaluating the influence of institutional type on academic library use (Ettelt, 1978, Ettelt, 1981). Although previous studies have not examined race or ethnicity I have included this variable in this study.

METHODOLOGY

Data Source

This study utilized data obtained from the 1992 - 1993 College Student Experiences Questionnaire (CSEQ) developed by C. Robert Pace in 1979.[1] The CSEQ was designed to determine the quality of effort that students put into using the campus facilities among other items (Pace, 1984). I examined data from four sections of the CSEQ: (1) background information, (2) library experiences, (3) perceptions of the college environment, and (4) estimate of gains. Missing data was coded.

Measures

I included a total of seven independent variables related to background information in the study based upon previous academic library use literature: age, sex, classification in college, grades, major field of study, racial or ethnic identification, and institutional type.

I selected nine variables measuring academic library use from the library experiences scale that contains 10 items measuring frequency of experiences. Additionally, I selected three variables identified as measuring perceptions of the college environment as a scholarly environment from the college environment scale. Finally, I selected variables that measured critical thinking skills from the estimate of gains scales. All measures used in the study and codings are located in Table A-1.

Subjects

I limited the analyses to undergraduate students at all class level (freshmen, sophomores, juniors, and seniors) and at all institutional types (Research Universities (RU), Doctoral Universities (DU), Comprehensive Colleges & Universities (CCU), General Liberal Arts Colleges (GLA), Selective Liberal Arts Colleges (SLA) and

[1] Data was provided by the Center for Postsecondary Research and Planning at Indiana University and was used with permission.

Associate of Art Institutions (AAI). I combined SLAs and GLAs to create a new category named Liberal Arts. I selected disciplines from humanities, physical sciences, social sciences as well as engineering and business so as to achieve a cross-section of scholarly areas. The CSEQ defined the fields as follows: humanities (literature, history, philosophy, religion, etc.); sciences (biological sciences = biology, biochemistry, botany, zoology, etc.; physical sciences = physics, chemistry, mathematics, astronomy, earth science, etc.); social sciences (economics, political science, psychology, sociology, etc.); engineering; and business. (Tables 1 - 5 provides descriptive information of my sample, based on means and standard deviations for all variables in the study).

I eliminated students who selected "other" as their racial or ethnic identification and graduate students from the sample. Additionally, I eliminated institutions that were not immediately identifiable as one of the types identified above.

The total sample was 9,361 students distributed across the disciplines as follows: humanities (1,014), physical sciences (1,988), social sciences (2,335), engineering (1,134), and business (2,890).

Analyses

I conducted exploratory factor analyses, utilizing orthogonal, principal axis factor rotation methods, to reduce the number of measured variables for analyses and to eliminate highly correlated variables. I used oblique factor analysis in this study because I assumed that these factors are correlated. I retained items that had a factor score of at least a .35 or over in the development of subsequent scales. These results are in Table 6, along with alpha reliabilities. I dropped the variable "Used the library as a quiet place to

read or study materials you brought with you" from the library experiences scales because of its low factor score (below .35). Additionally, I also dropped two variables, "emphasis on the development of vocational and occupational competence" and "emphasis on the personal relevance and practical values of your courses" from the perceptions of the college environment. These two variables had lower factor scores than the three remaining variables and the content of the statement did not meet my definition of perceptions of a scholarly college environment. (Tables 6 and A-2 report the results of the factor analyses).

I substituted missing data with the means for each variable. I created dummy variables for both the institutional type and major field of study variables. I used the Associate of Arts Institutions and the majors in the Sciences comparison groups. I conducted a multiple regression analysis to identify the significant determinants of the development of critical thinking skills. First, I entered independent variables that reflected student background characteristics. Secondly, I entered the library experiences factors, and finally I entered the perceptions of the college environment factors. The order in which the sets of variables were entered was based on the work of Blackburn and Lawrence (1995) and Fishbein and Ajzen (1975). (See Table A-1 for a listing of scales and measures used in the regression model).

Results

In order to examine the degree to which students from different institutional types with different majors differed by the student background characteristics, perceptions of the

college environment, and estimate of gains, I calculated mean levels and standard deviations. (The results of all means and standard deviations are reported in Tables 1 - 5).

Block hierarchical regression analyses revealed that, in terms of estimated gains in critical thinking skills, perceptions of the college environment accounted for the largest share of the explained variance (10%) when compared to student background characteristics (5%), and library searching (2%) and library reference activities (2%) for a total of 19%.

Table 7 shows the beta coefficients from regressing estimated gains of critical thinking skills on each of the independent measures. Based upon the students' background characteristics, the results of the multiple regression analyses indicate older students are less likely to report gains in critical thinking skills. Interestingly, juniors and seniors are more likely to report gains in critical thinking skills. Students with higher grade point averages also reported greater gains in critical thinking skills. Gains in critical thinking skills were less likely to be reported by students in the humanities when compared to students in other fields. Engineering students reported more significant gains in critical thinking skills than students in business. Students in research, comprehensive, and liberal arts schools reported lower gains in critical thinking skills when compared to students in associate of arts institutions.

Students' perceptions of the college environment had a high beta (.30). If students' perceived their college environment to be scholarly they were more inclined to report greater gains in critical thinking skills. Finally, the greater the frequency of library activities the more likely that students were reporting gains in their critical thinking skills.

Discussion

This study provides insights into determining what factors influence estimated gains of critical thinking skills in undergraduates majoring in different disciplines and attending different institutional types. I assessed background characteristics, the perception of the institutional climate, and academic library experiences in order to understand their influence on the development of critical thinking skills.

Implications

The results of the analyses indicate that undergraduate students' perceptions of their college environment has the most influence on students reporting gains in their development of critical thinking skills. This study does not address what college experiences determine students' perceptions of their college environment. Future studies might analyze types of college experiences that influences students' perceptions of their college environment. An analysis of course content, instructional and evaluation methods (i.e. types of assignments, lectures, examinations, research papers) in each discipline might be helpful to address why there are disciplinary differences in reporting gains in critical thinking.

Reference

Astin, A. W. (1993a). Assessment for Excellence: The Philosophy and Practice of Assessment and Evaluation in Higher Education. Phoenix, AZ: Oryx Press.

Becher, T. (1987). The disciplinary shaping of the profession. In B. R. Clark (editor), The Academic Profession: National Disciplinary, and Institutional Settings (pp. 271-303). Berkeley: University of California Press.

Becher, T. (1994). The significance of disciplinary differences. Studies in Higher Education, 19(2), 151-161.

Blackburn, R.T., & Lawrence, J.H. (1995). Faculty at Work: Motivation, Expectation, Satisfaction. Baltimore, MD: John Hopkins University Press.

Churchill, W. D., & Iwai, S. I. (1981). College attrition, student use of campus facilities, and a consideration of self-reported personal problems. Research in Higher Education, 14(4), 353-365.

Ettelt, H. J. (1978). Book use at a small (very) community college library. Library Journal, 103, 2314-2315.

Ettelt, H. J. (1981). Use of library materials at a small liberal arts college. Library Research, 3, 261-282.

Gowler, S. (1995). The habit of seeking: Liberal education and the library at Berea College. Library Trends, 44(2), 387-399.

Hativa, N., & Marincovich, M. (editors). (1996). Disciplinary Differences in Teaching and Learning. San Francisco: Jossey-Bass.

Hiscock, J. E. (1986). Does library usage affect academic performance? Australian Academic & Research Libraries, 17(4), 207-214.

Kosa, G. (1982). The psychological barrier between college students and the librarian. Australian Academic & Research Libraries, 13, 102-112.

Kramer, L. A., & Kramer, M. B. (1968). The college library and the drop-out. College & Research Libraries, 310-312.

Kuh, G. D., & Whitt, E. J. (1988). The Invisible Tapestry: Culture in American Colleges and Universities. Washington, DC: ASHE.

Lane, G. (1966). Assessing the undergraduates' use of the university library. College & Research Libraries, 27(4), 277-282.

MacAdam, B. (1995). Sustaining the culture of the book: The role of enrichment reading and critical thinking in the undergraduate curriculum. Library Trends, 44(2), 237-263.

Mays, T. (1986). Do undergraduates need their libraries? Australian Academic & Research Libraries, 17(2), 51-62.

Mech, T. F. (1990). Working with faculty in an outcomes-oriented curriculum: Observations from the library. In H. P. Hall, & C. Byrd (Eds), The Librarian in the University: Essays on Membership in the Academic Community (pp. 72-91). Metuchen, NJ: Scarecrow Press.

Pace, C. R. (1984). Measuring the Quality of College Student Experiences. Los Angeles, CA: Higher Education Research Institute - Graduate School of Education - University of California, Los Angeles.

Plum, S. H. (1984). Library use and the development of critical thought. In T. G. Kirk (Ed), Increasing the teaching role of academic libraries (pp. 25-33). San Francisco: Jossey-Bass.

Weaver, F. S. (1981). Academic disciplines and undergraduate liberal arts education. Liberal Education, 67(2), 151-165.

Wells, J. (1995). The influence of library usage on undergraduate academic success. Australian Academic & Research Libraries, 26(2), 121-128.

Table 1

Means and Standard Deviations of Background Information, Library Experiences, Perceptions of the College Environment, and Estimate of Gains by Discipline by Institutional Type **Humanities (N=1014)**

	Research			Doctoral			Comprehensive			Liberal Arts			Associate		
	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N
Background Info															
Age	1.49	.75	235	1.80	.84	110	1.38	.70	421	1.14	.46	243	1.00	.00	4
Class	2.90	1.07	235	3.18	.97	111	2.65	1.27	421	2.51	1.33	243	1.00	.00	4
Grades	3.38	1.14	234	3.48	1.11	110	3.48	1.11	420	3.50	1.07	242	2.50	1.73	4
Race	.29	.45	235	.06	.24	111	.08	.27	421	.08	.28	243	.50	.58	4
Gender	.64	.48	234	.54	.50	110	.62	.49	421	.59	.49	243	.50	58	4
Library Experiences															
Used catalogue	2.61	.92	233	2.61	.98	111	2.81	.87	420	2.82	.86	243	2.00	.82	4
Asked librarian	1.97	.77	232	1.85	.73	111	2.09	.76	420	2.08	.78	243	2.00	.82	4
Read in reserve	2.03	.76	232	1.92	.82	111	2.15	.82	419	2.34	.94	243	1.25	.50	4
Used indexes	1.90	.79	233	1.85	.80	111	2.19	.84	416	2.19	.86	243	2.00	.00	4
Dev. bibliography	2.44	.93	233	2.36	.99	111	2.70	.90	420	2.76	.92	243	2.25	.50	4
Browsed in stacks	1.90	.91	234	1.87	.93	111	2.03	.94	419	2.17	.98	241	2.75	.50	4
Checked citations	1.92	.86	233	2.00	.92	111	2.00	.93	418	2.14	.97	242	2.00	.82	4
Read basic references	1.70	.81	235	1.76	.80	111	1.74	.82	419	1.81	.85	242	1.75	.96	4
Checked out books	2.03	.98	235	2.00	.95	111	2.13	.99	419	2.26	1.02	243	2.50	.58	4
Perceptions of the College Environment															
Esthetic, expressive	4.35	1.38	230	4.03	1.44	108	4.66	1.33	417	5.03	1.44	241	5.75	.96	4
Academic, scholarly	5.03	1.37	230	4.93	1.44	108	5.24	1.22	416	5.93	1.05	241	4.75	2.06	4
Critical, evaluative	5.20	1.29	230	5.10	1.30	108	5.10	1.23	416	5.57	1.20	241	4.50	1.91	4
Estimate of Gains															
Inquiry	3.12	.83	231	3.19	.75	107	3.06	.81	418	3.25	.76	241	3.50	.58	4
Analytical thinking	2.76	.90	230	2.80	.86	107	2.66	.87	417	2.93	.79	241	2.25	.50	4
Synthesis	3.00	.84	230	2.86	.84	107	2.91	.80	417	3.05	.78	241	3.0	.82	4
Quantitative thinking	1.91	.81	226	1.97	.81	105	1.91	.82	410	2.03	.87	236	1.5	.58	4

Note: Variable scales are reported in table A-1.

BEST COPY AVAILABLE

Table 2

Means and Standard Deviations of Background Information, Library Experiences, Perceptions of the College Environment, and Estimate of Gains by Discipline by Institutional Type **Sciences (N=1988)**

	Research			Doctoral			Comprehensive			Liberal Arts			Associate		
	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N
Background Info															
Age	1.15	.41	517	1.40	.67	221	1.19	.49	886	1.05	.29	347	1.40	.74	15
Class	2.27	1.18	519	2.45	1.27	221	2.10	1.16	886	2.00	1.22	347	1.27	.46	15
Grades	3.24	1.13	517	3.34	1.15	218	3.33	1.17	885	3.34	1.15	341	3.47	1.25	15
Race	.51	.50	519	.29	.46	221	.22	.42	886	.15	.36	347	.13	.35	15
Gender	.53	.50	519	.51	.50	221	.59	.49	886	.54	.50	347	.40	.51	15
Library Experiences															
Used catalogue	2.34	.85	516	2.42	.97	221	2.52	.84	884	2.60	.80	347	2.60	1.06	15
Asked librarian	1.83	.75	516	1.86	.76	221	1.96	.78	885	2.01	.73	347	2.27	.96	15
Read in reserve	1.86	.79	517	1.94	.82	221	2.03	.83	885	2.18	.86	344	2.20	1.08	15
Used indexes	1.84	.81	516	1.80	.85	221	2.11	.83	886	2.16	.82	346	2.07	1.00	14
Dev. bibliography	2.18	.91	519	2.02	.88	220	2.30	.91	886	2.57	.83	346	2.33	1.11	15
Browsed in stacks	1.73	.81	519	1.82	.89	221	1.78	.85	886	1.97	.81	346	2.53	.99	15
Checked citations	1.71	.82	517	1.75	.86	221	1.72	.80	885	1.85	.82	347	2.40	.99	15
Read basic references	1.45	.67	517	1.55	.77	221	1.46	.67	886	1.59	.72	346	1.93	.92	14
Checked out books	1.76	.84	518	1.84	.91	221	1.83	.85	885	1.96	.87	346	2.27	1.10	15
Perceptions of the College Environment															
Esthetic, expressive	4.30	1.26	516	3.96	1.39	220	4.60	1.26	882	5.06	1.24	347	4.53	1.41	15
Academic, scholarly	5.31	1.17	516	5.19	1.42	220	5.43	1.23	883	5.87	1.06	347	4.53	1.81	15
Critical, evaluative	5.10	1.25	516	4.99	1.36	220	5.10	1.25	882	5.52	1.14	347	4.53	1.41	15
Estimate of Gains															
Inquiry	2.86	.84	515	2.88	.82	221	2.90	.82	873	2.91	.81	342	2.67	.82	15
Analytical thinking	2.82	.80	515	2.90	.82	221	2.93	.81	875	2.97	.81	343	2.93	.96	15
Synthesis	2.79	.79	514	2.82	.78	220	2.82	.80	875	2.89	.77	343	2.67	.82	15
Quantitative thinking	2.63	.85	505	2.68	.85	218	2.73	.87	869	2.71	.88	337	2.53	.83	15

Note: Variable scales are reported in table A-1.

Table 3

Means and Standard Deviations of Background Information, Library Experiences, Perceptions of the College Environment, and Estimate of Gains by Discipline by Institutional Type **Social Science (N=2335)**

	Research			Doctoral			Comprehensive			Liberal Arts			Associate		
	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N
Background Info															
Age	1.33	.64	601	1.56	.77	291	1.34	.67	1069	1.12	.39	344	1.96	1.00	26
Class	2.73	1.20	602	2.99	1.03	291	2.51	1.20	1072	2.23	1.30	344	1.19	.40	26
Grades	3.15	1.13	599	3.17	1.17	291	3.10	1.16	1065	3.10	1.06	343	3.46	1.38	24
Race	.44	.50	602	.24	.43	291	.20	.40	1072	.15	.35	344	.23	.43	26
Gender	.64	.48	601	.64	.48	291	.68	.47	1072	.70	.46	343	.73	.45	26
Library Experiences															
Used catalogue	2.54	.90	600	2.45	.94	291	2.61	.89	1072	2.61	.82	343	2.42	1.03	26
Asked librarian	1.98	.78	599	1.99	.81	291	2.17	.81	1072	2.03	.78	344	2.19	.90	26
Read in reserve	1.88	.76	600	1.98	.85	290	2.07	.85	1070	2.10	.81	344	1.85	.83	26
Used indexes	1.98	.85	600	2.01	.84	291	2.24	.88	1069	2.17	.88	344	2.27	.96	26
Dev. bibliography	2.39	.90	600	2.36	.92	290	2.47	.91	1071	2.58	.83	342	2.50	1.03	26
Browsed in stacks	1.71	.82	601	1.62	.80	291	1.81	.83	1071	1.87	.86	344	1.96	.72	26
Checked citations	1.79	.83	602	1.78	.86	289	1.84	.85	1069	1.78	.81	343	1.88	.77	26
Read basic references	1.46	.67	601	1.54	.76	290	1.56	.73	1070	1.51	.75	342	1.62	.64	26
Checked out books	1.77	.83	601	1.77	.88	289	1.89	.87	1070	1.93	.89	343	1.96	.89	25
Perceptions of the College Environment															
Esthetic, expressive	4.24	1.42	599	4.29	1.37	287	4.66	1.30	1067	5.03	1.20	341	4.92	1.08	25
Academic, scholarly	5.16	1.37	598	5.08	1.21	288	5.24	1.20	1066	5.81	1.00	341	5.44	1.36	25
Critical, evaluative	5.07	1.36	599	5.01	1.29	288	5.02	1.20	1067	5.35	1.12	341	5.20	1.12	25
Estimate of Gains															
Inquiry	2.95	.84	599	2.82	.85	284	2.96	.79	1063	3.04	.74	344	3.20	.82	25
Analytical thinking	2.71	.84	598	2.68	.90	285	2.69	.79	1066	2.80	.80	343	3.08	.76	25
Synthesis	2.83	.83	599	2.73	.80	285	2.85	.76	1063	2.90	.78	343	2.72	.89	25
Quantitative thinking	2.22	.88	594	2.24	.92	282	2.31	.84	1042	2.26	.87	340	2.72	.98	25

Note: Variable scales are reported in table A-1.

BEST COPY AVAILABLE

Table 4

Means and Standard Deviations of Background Information, Library Experiences, Perceptions of the College Environment, and Estimate of Gains by Discipline by Institutional Type **Engineering (N=1134)**

	Research			Doctoral			Comprehensive			Liberal Arts			Associate		
	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N
Background Info															
Age	1.23	.55	428	1.77	.80	369	1.41	.69	283	1.18	.55	28	1.88	.95	26
Class	2.14	1.20	428	3.22	1.08	369	2.46	1.28	283	1.36	.68	28	1.15	.37	26
Grades	3.14	1.15	426	2.89	1.11	368	2.99	1.19	280	3.39	1.26	28	3.23	1.24	26
Race	.52	.50	428	.24	.43	369	.33	.47	283	.32	.48	28	.35	.49	26
Gender	.27	.45	428	.11	.32	369	.22	.42	283	.21	.42	28	.08	.28	25
Library Experiences															
Used catalogue	2.23	.88	426	2.24	.87	368	2.30	.89	283	2.32	.77	28	2.00	.80	26
Asked librarian	1.74	.70	426	1.76	.72	368	1.76	.73	283	1.89	.74	28	2.00	.98	26
Read in reserve	1.75	.72	427	1.72	.73	368	1.85	.82	281	1.82	.61	28	1.73	.83	26
Used indexes	1.68	.74	427	1.77	.78	367	1.79	.81	283	1.86	.80	28	1.96	.82	26
Dev. bibliography	1.99	.86	427	1.96	.78	369	2.01	.91	283	2.14	.97	28	2.04	.77	26
Browsed in stacks	1.75	.82	427	1.71	.79	367	1.80	.89	282	1.75	.97	28	1.96	.82	26
Checked citations	1.54	.72	427	1.64	.79	369	1.66	.80	282	1.57	.74	28	1.96	.82	26
Read basic references	1.35	.60	427	1.45	.69	367	1.47	.70	282	1.36	.62	28	1.65	.94	26
Checked out books	1.70	.83	427	1.68	.80	367	1.79	.90	282	1.71	.85	28	1.88	.91	26
Perceptions of the College Environment															
Esthetic, expressive	4.30	1.37	426	3.98	1.37	363	4.55	1.35	280	4.89	1.34	28	4.80	1.32	25
Academic, scholarly	5.30	1.25	427	4.99	1.32	364	5.39	1.17	282	5.93	.90	28	5.12	.97	25
Critical, evaluative	5.09	1.30	427	5.07	1.37	365	5.32	1.29	282	4.96	1.23	28	5.04	1.21	25
Estimate of Gains															
Inquiry	2.84	.83	423	2.98	.76	367	2.90	.84	279	2.86	.97	28	2.65	.89	26
Analytical thinking	2.95	.81	423	3.12	.78	365	3.03	.84	279	2.89	.83	28	2.42	.86	26
Synthesis	2.79	.80	423	2.95	.75	366	2.91	.83	279	2.93	.90	28	2.42	.76	26
Quantitative thinking	2.85	.84	420	2.92	.84	363	2.88	.91	275	2.71	.90	28	2.35	.94	26

Note: Variable scales are reported in table A-1.

Table 5

Means and Standard Deviations of Background Information, Library Experiences, Perceptions of the College Environment, and Estimate of Gains by Discipline by Institutional Type **Business (N=2890)**

	Research			Doctoral			Comprehensive			Liberal Arts			Associate		
	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N
Background Info															
Age	1.23	.53	678	1.74	.79	450	1.31	.63	1312	1.17	.51	375	1.73	.89	75
Class	2.40	1.25	678	3.18	1.09	450	2.54	1.26	1312	2.36	1.31	375	1.32	.50	75
Grades	3.15	1.13	674	2.94	1.08	450	3.09	1.13	1303	2.95	1.16	372	3.27	1.19	74
Race	.46	.50	678	.25	.43	450	.19	.40	1312	.16	.37	375	.24	.43	75
Gender	.51	.50	678	.41	.49	449	.54	.50	1312	.45	.50	374	.72	.45	75
Library Experiences															
Used catalogue	2.35	.85	676	2.19	.92	450	2.51	.88	1311	2.42	.81	374	2.43	.95	75
Asked librarian	1.91	.74	675	1.89	.81	450	2.09	.76	1310	2.03	.76	375	2.19	.90	75
Read in reserve	1.81	.76	674	1.73	.80	450	1.93	.80	1310	2.00	.75	375	1.79	.76	75
Used indexes	1.84	.77	673	1.78	.78	449	2.08	.82	1310	1.99	.72	375	2.09	.92	75
Dev. bibliography	2.12	.83	675	1.94	.90	449	2.33	.90	1311	2.45	.80	374	2.25	.92	75
Browsed in stacks	1.58	.74	677	1.58	.82	450	1.70	.80	1311	1.79	.83	374	2.08	.93	75
Checked citations	1.57	.72	675	1.55	.74	450	1.69	.77	1308	1.74	.77	374	1.93	.79	75
Read basic references	1.31	.55	676	1.36	.61	450	1.43	.62	1308	1.49	.70	375	1.68	.68	75
Checked out books	1.69	.76	676	1.56	.78	450	1.72	.80	1310	1.81	.86	375	1.88	.94	75
Perceptions of the College Environment															
Esthetic, expressive	4.49	1.25	671	4.07	1.31	447	4.57	1.22	1301	4.91	1.25	374	4.85	1.26	75
Academic, scholarly	5.18	1.09	672	4.81	1.29	447	5.32	1.14	1302	5.59	1.01	374	5.28	1.19	75
Critical, evaluative	4.91	1.19	672	4.78	1.34	447	4.93	1.17	1299	5.18	1.09	373	4.81	1.31	75
Estimate of Gains															
Inquiry	2.78	.81	670	2.83	.83	441	2.87	.78	1295	2.94	.76	370	2.83	.84	75
Analytical thinking	2.58	.80	669	2.67	.78	442	2.68	.78	1294	2.94	.77	372	2.44	.83	75
Synthesis	2.69	.79	670	2.69	.76	442	2.71	.79	1294	2.80	.78	371	2.61	.79	75
Quantitative thinking	2.48	.87	658	2.55	.85	440	2.51	.85	1280	2.60	.80	368	2.39	.93	74

Note: Variable scales are reported in table A-1.

Table 6

Factor Loadings and Internal Consistencies for Exploratory Factor Model of Library Experiences, Perceptions of the College Environment, and Estimate of Gains Variables

Factors and Survey Items	Factor Loading	Internal Consistency (Alpha)
Library Reference Activities		.77
Used indexes to journal articles	.68	
Developed bibliography	.66	
Used card catalogue or computer	.65	
Asked librarian for help	.49	
Read in reserve or reference section	.44	
Library Probing Activities		.76
Checked citations in things read	.66	
Read basic references or documents	.66	
Found material by browsing in stacks	.64	
Checked out books	.52	
Perceptions of the College Environment		.77
Emphasis on being critical, evaluative	.70	
Academic, scholarly qualities	.69	
Esthetic, expressive, creative qualities	.65	
Estimate of Gains		.82
Gain in ability to put ideas together	.68	
Gain in ability to think analytically	.61	
Gain in ability to learn on own	.53	
Gain in quantitative thinking	.51	

Tabie 7

Summary of Hierarchical Regression Analysis for Variables Predicting Estimated Gains of Critical Thinking Skills

Variable	Beta	Significance
Step 1		
Age of student	-.050	***
Classification in college	.192	***
Most college grades	.081	***
Race/Ethnicity	-.013	
Gender of student	-.014	
Humanities	-.030	***
Social Science	-.005	
Engineer	.097	***
Business	.014	*
Research	-.042	*
Doctoral	-.021	
Comprehensive	-.058	*
Liberal Arts	-.050	**
R^2 for Block One = .05		
Step 2		
Perceptions of the College Environment	.302	***
R^2 for Block Two = .15		
Step 3		
Library Reference Activities	.088	***
R^2 for Block Three = .17		
Step 4		
Library Searching Activities	.126	***
R^2 for Final Block = .19		

Variable scales are reported in Table A-1. (*p= ≤ 05, **p =≤ 01, ***p=≤ 001)

Appendix

Table A-1

Measures and Scales for the Regression Model

Background Information	
Age	1 = 22 or younger to 3 = 28 or older
Class	1 = freshman to 4 = senior
Grades	1 = C, C, or lower to 5 = A
Race	1 = minority; 0 = white
Gender	1 = female; 0 = male
Humanities	1 = humanities; 0 = else
Sciences	(excluded category)
Social Science	1 = social science; 0 = else
Engineering	1 = engineering; 0 = else
Business	1 = business; 0 = else
Research Universities	1 = research; 0 = else
Doctoral Universities	1 = doctoral; 0 = else
Comprehensive Colleges and Universities	1 = comprehensive; 0 = else
Selective and General Liberal Arts Colleges	1 = liberal arts; 0 = else
Associate of Arts Institutions	(excluded category)
Library Experiences	
Used card catalogue or computer	1 = never to 4 = very often
Asked librarian for help	1 = never to 4 = very often
Read in reserve or reference section	1 = never to 4 = very often
Used indexes to journal articles	1 = never to 4 = very often
Developed bibliography	1 = never to 4 = very often
Found material by browsing in stacks	1 = never to 4 = very often
Checked citations in things read	1 = never to 4 = very often
Read basic references or documents	1 = never to 4 = very often
Checked out books	1 = never to 4 = very often
Perceptions of the College Environment	
Academic, scholarly qualities	1 = weak emphasis to 7 = strong emphasis
Esthetic, expressive, creative qualities	1 = weak emphasis to 7 = strong emphasis
Emphasis on being critical, evaluative	1 = weak emphasis to 7 = strong emphasis
Estimate of Gains	
Gain in ability to think analytically	1 = very little to 4 = very much
Gain in quantitative thinking	1 = very little to 4 = very much
Gain in ability to put ideas together	1 = very little to 4 = very much
Gain in ability to learn on own	1 = very little to 4 = very much

Table A-2
Factor Scale: Estimates of Internal Consistencies (Alpha) by Student Sample

Factor Scale	Number of items	
Library Reference Activities	5	.77
Library Probing Activities	4	.76
Perceptions of the College Environment	3	.77
Estimate of Gains	4	.82

Note: Items constituting each scale are reported in Table 6.
Exploratory procedures used to develop scales are reported in the methodology section.